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International application number: PCT/CA05/000534

International filing date: 07 April 2005 (07.04.2005)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/560,981
Filing date: 12 April 2004 (12.04.2004)

Date of receipt at the International Bureau: 15 June 2005 (15.06.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

PA 1304429

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APPLICATION NUMBER: *60/560,981*
FILING DATE: *April 12, 2004*

PCT/CA05/00534

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No.

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
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Additional inventors are being named on the _____ separately numbered sheets attached hereto

TITLE OF THE INVENTION (500 characters max)

METHOD FOR MANUFACTURING A CIRCULAR METAL TANK

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Specification *Number of Pages* 8 ☐ CD(s), Number _____

☑ Drawing(s) *Number of Sheets* 12 ☑ Other (specify) return postcard

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees.

☐ The Director is herby authorized to charge filing fees or credit any overpayment to Deposit Account Number: _____

☑ Payment by credit card. Form PTO-2038 is attached.

FILING FEE Amount ($): 80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☑ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE C. Vermette

Date April 8, 2004

REGISTRATION NO. 30,018 *(if appropriate)*

Docket Number: 2414-100

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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

Method for Manufacturing a Circular Metal Tank

Field of the Invention

This invention relates generally to circular metal tanks and a method for the manufacture thereof from steel coils shipped to site straight from a metal mill, (e.g. steel mill) without any intermediate manufacturing.

Background of the Invention

The prior art describes a variety of methods for the construction of circular metal tanks used in the storage of solids or liquids. For instance, US patent 2,751,672, issued to Reed, describes the fabrication of circular tanks from a series of metal sheets, which are bolted together. This method of assembly requires a large amount of manual labour, a complicated tank support structure, and is unsuitable for producing tanks for storage of liquids due to the massive number of bolt holes requiring hydraulic seals to prevent the leakage of any stored liquid.

US patent 4,121,747, issued to McFatter, describes the construction of circular storage tanks from strip metal wound in a helical path such that the tank is built upwardly. The metal strip is fed to a support assembly arranged circularly on a base, and the upper edge of the strip that is fed to the support assembly is aligned with the lower edge of the helical turn immediately above so that the edges are spaced apart in a vertical plane from each other and then "butt" welded together. This technique for tank fabrication suffers from the following major disadvantages:

- slight misalignment of the adjacent metal strips, especially for thinner metal thicknesses, can cause weak welds due to insufficient metal-to-metal contact or leaks in the case of liquid storage tanks;

- satisfactory alignment of metal strips ahead of a butt welder is difficult; and

- there is no provision for reinforcement of adjacent metal strips to prevent their deformation (e.g. bulging due to high-pressure in a tall liquid storage tank thereby putting unnecessary pressure on the tank walls, including butt welds).

Summary of the Invention

This invention comprises a novel circular metal tank and a method of manufacture thereof from coiled strips of metal. In particular, the invention is a method of constructing such tanks on site from one or more metal strips bent on both their upper and lower longitudinal edges and wound helically such that the tank wall is gradually pushed upwards while the adjacent upper and lower bends of the metal strip are welded together. The welded bends can be used as tracks, which allow the tank wall to be supported by rollers, which guide the revolving circular tank wall upwards in a helical path. The unwound metal coil optionally contains single or multiple corrugations (wave-forms) between to prevent bulging.

Bending the edges of the metal strips achieves the following:

- easier alignment of adjacent edges of the metal strips to achieve stronger welds (e.g. fillet welds) with much better hydraulic seals;

- the forming of tracks which receive and allow the tank to be supported on free or motorized rollers, thereby simplifying the tank wall positioning and the tank support structure assembly; and

- strengthening the tank walls such that undesirable bulging and strain on tank welds is avoided.

Detailed Description of Invention

Further features and advantages will be apparent from the following detailed description, given by way of example, of a preferred embodiment taken in conjunction with the accompanying Figures.

Figure IIa is a top view of tank being constructed according to the method of the present invention. Figure IIa illustrates the major tank production subsystems as follows:

- Decoiler – unravels a metal coil into a Bender/Corrugator.
- Bender/Corrugator – bends the upper and lower edges of the metal strip and optionally forms reinforcing corrugations along the longitudinal axis of the decoiled metal strip.
- Welding Pre-aligner – manual or motorized to "gross" position adjacent bent edges of metal strips ahead of a Welding Positioner
- Welding Positioner – manual or motorized to "fine" position adjacent bent edges of metal strips exiting the Welding Pre-Aligner and entering a Welder Assembly.
- Welder – manual or automatic single or double welder to join (e.g. fillet weld) adjacent bent edges of the metal strips.
- Free or Motorized Roller Assembly – having single and double rollers, with or without motors, plus positioners that guide and support the welded metal strips in a circular motion on an adjustable circular incline (i.e. a helical path).

- Free Single Roller Assembly – device with motorized or un-motorized rollers, which support the tank metal strip at the exterior part of the tank in construction via the welded metal track.

- Double Free or Motorized Roller Assembly – device with motorized or un-motorized rollers which support and position the tank metal strip at the exterior part of the tank in construction.

- Vertical Coil Seam Welder – joins consecutive metal strips by welding a vertical seam between the ends the strips (e.g. butt weld).

Figure IIb illustrates a typical sequence of single and double rollers showing inclined adjacent metal strips drawn as if it they were flat and unwound (although they actually form a circle – i.e. "start" and "finish" are connected e.g. "Mercator" projection).

Figure IIIa illustrates a motorized bender/corrugator, which creates an upper "L" bend and a lower "chair" bend on a metal strip.

Figure IIIb illustrates a motorized bender/corrugator which creates an upper "L" bend and a lower "chair" bend plus a single corrugated bend on a metal strip.

Figure IIIc illustrates a motorized bender/corrugator which creates an upper "L" bend and a lower "chair" bend plus a double corrugated bend on a metal strip.

In Figures III d-f cross section of the metal strip before it enters the bender/corrugator is shown on the right and the cross section of the metal strip as it exits the bender corrugator is shown on the left.

Figure IIId illustrates the cross section of the bent strip output from the Figure IIIa bender/corrugator.

Figure IIIe illustrates the cross section of the bent strip output from the Figure IIIb bender/corrugator.

Figure IIIf illustrates the cross section of the bent strip output from the Figure IIIc bender/corrugator.

Figure IVa illustrates the welding pre-aligner as follows:

- Horizontal adjustable rollers – roller A pushes the upper edge of the lower unwelded part of the metal strip in the exterior direction (from the inside of the "tank" towards the outside) whereas roller B pushes both the upper edge of the lower unwelded part of the metal strip and the lower edge of the upper part of the metal strip in the exterior direction.

- Horizontal roller adjustors – Adjustors C and D regulate the horizontal positioning of rollers A and B.

- Free or motorized double rollers – Unwelded roller track illustrated in figure IVb is supported underneath by roller E while roller F pushes/positions the higher "chair" bend downwards towards the L bend. Rollers E and F can be simultaneously horizontally adjusted while roller F can be vertically adjusted upwards or downwards.

Figure IVb illustrates one example of a roller track formed by the adjacent "L" and "chair" bent edges of unwelded metal strips.

Figure IVc shows a close up view of two adjacent unwelded "L" and "chair" bent edges passing through the double free or motorized rollers in the welding pre-aligner shown in Figure IVa.

Figure Va illustrates the welding positioner as follows:

- Horizontal adjustable rollers – roller A pushes the upper edge of the lower unwelded part of the metal strip in the exterior direction (from the inside of the tank towards the outside) whereas roller B pushes the lower edge of the upper unwelded part of the metal strip in the exterior direction.

- Horizontal roller adjustor– Adjustors C and D regulate the horizontal positioning of rollers A and B.

- Motorized double rollers – Rollers E and F engage the adjacent "L" and "chair" bends of the metal strip. Roller F pushes/positions the higher "chair" bend downwards towards the L bend. Rollers E and F can be simultaneously horizontally adjusted while roller E can be vertically adjusted upwards or downwards.

Figure Vb shows a close up of Rollers E and F of Figure Va and adjacent "L" and "chair" bent edges of the metal strip passing therethrough (see Figure Va).

Figure VIa illustrates a welder applying a continuous weld to the interior groove of adjacent chair and L bends (e.g. fillet weld). The adjacent "chair" and "L" bent edges of the metal strip may be single of double welded (i.e. an additional weld may be performed at the point where the "L" bent edge of the metal strip terminates).

Figure VIb is a plan view of the interior surface of a tank wall according to the present invention showing the weld between adjacent portions of the metal strip.

Figure VIc illustrates a single-welded roller track formed by welded adjacent "L" and "chair" bent edges of the metal strip. The roller track can receive a single free roller assembly, which supports and moves/positions the tank during construction.

Figure VId illustrates welded adjacent "L" and "chair" bent edges of the metal strip engaged by motorized or free double rollers.

Figure VIIa illustrates a single free roller assembly as follows:

- Tiltable adjustable welded track roller – the roller can be tilted away from vertical alignment towards the centre of the tank while maintaining the roller contact with the welded roller track formed by the "L" and "chair" bends to maintain fine control of tank diameter.
- Height adjustor – a double threaded roller height adjuster (i.e. to control the shape and incline of the helical winding.
- Vertical support – positions the roller track and height adjuster relative to all other components on the main component assembly (see Figure IIa).

Figure VIII illustrates a decoiler assembly, which uncoils the metal strip.

Figure IX shows a tank according to the present invention which is near completion. The tank is shown before and after the top has been leveled.

It should be clear to those skilled in the art that a variety of metal bends can be used to create alternate track shapes. For example, the edges of the metal strip may be bent to configurations other than "L" and "chair" bends (e.g. non-right angle bends) while still providing both reinforcement of the tank walls and tracks for engaging rollers. In addition, a variety of waveforms can be used optionally to reinforce the metal strips.

Finally any number of prior art techniques finishing/cutting the top and the bottom the circular tank can be used to give it a top and bottom edge which is parallel (no longer inclined) to the ground followed by a welded base with or without a welded top. (e.g. see US patent 4,121,747).

After completion of the welding and horizontal cutting of the bottom, the tank is lowered onto the ground by reversing the rotation of rollers.

Figure IIa illustrates the major tank production subsystems as follows:

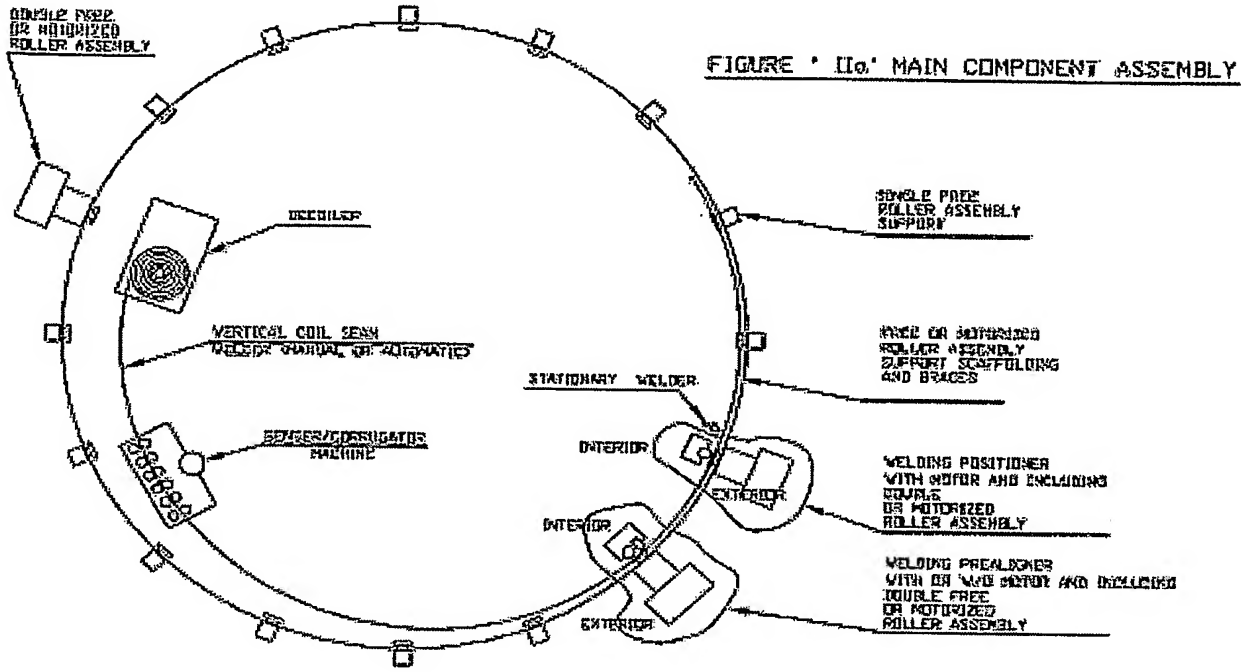

Figure IIb illustrates a typical sequence of single and double rollers showing inclined adjacent metal strips drawn as if it they were flat and unwound (although they actually form a circle – i.e. "start" and "finish" are connected e.g. "Mercator" projection) seen from the interior view.

FIGURE "II b" DOUBLE AND SINGLE
ROLLER SCAFFOLDING INCLINER

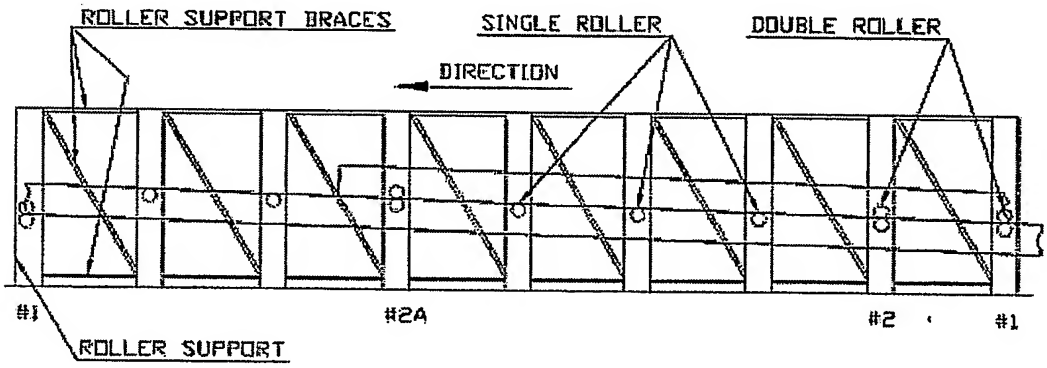

Figure IIIa illustrates a motorized bender/corrugator which creates an upper "L" bend and a lower "chair" bend on a metal strip.

FIGURE "III a " BENDER / CORRUGATOR

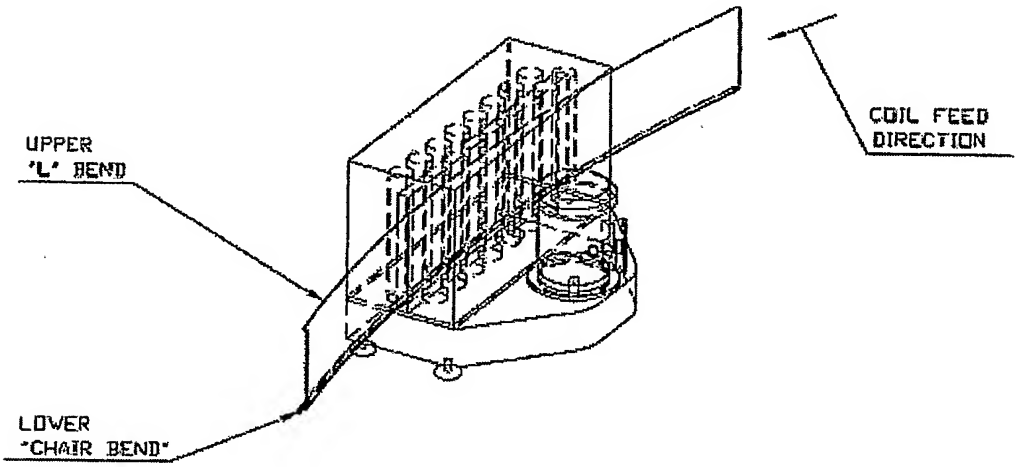

Figure IIIb illustrates a motorized bender/corrugator which creates an upper "L" bend and a lower "chair" bend plus a single corrugated bend on a metal strip.

FIGURE "III b" BENDER / CORRUGATOR

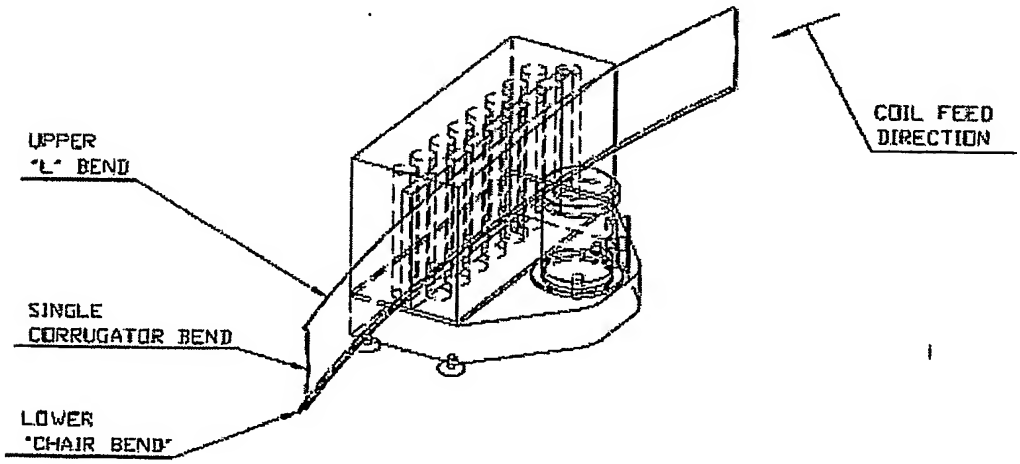

Figure IIIc illustrates a motorized bender/corrugator which creates an upper "L" bend and a lower "chair" bend plus a double corrugated bend on a metal strip.

FIGURE "III c" BENDER / CORRUGATOR

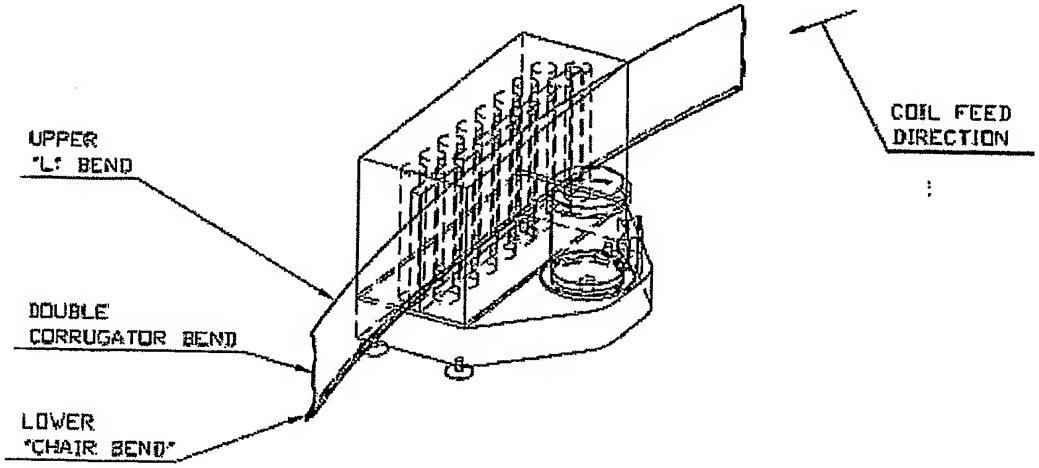

Figure IIId illustrates the cross section of the bent coil output from the Figure IIIa bender/corrugator.

FIGURE "III d" BEND COIL OUTPUT (NO CORRUGATION)

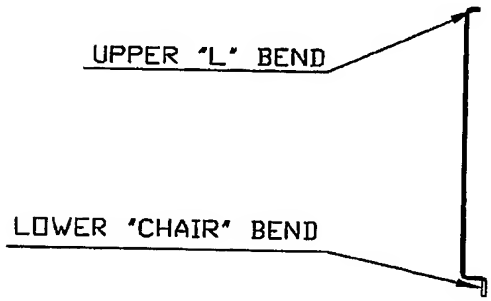

Figure IIIe illustrates the cross section of the bent coil output from the Figure IIIb bender/corrugator.

FIGURE " III e" BEND COIL OUTPUT (ONE CORRUGATION)

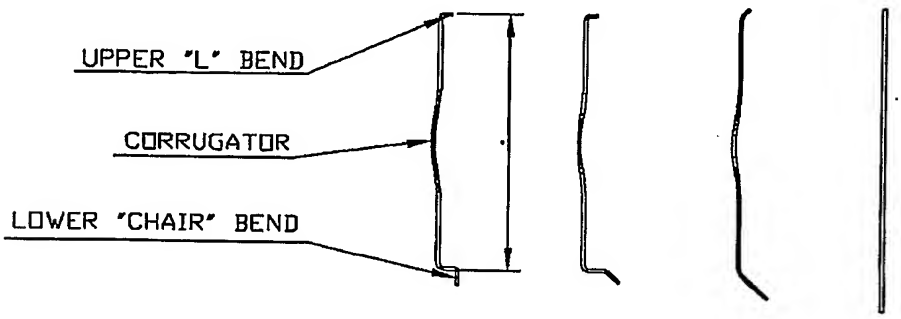

Figure IIIf illustrates the cross section of the bent coil output from the Figure IIIc bender/corrugator.

FIGURE " III f" BEND COIL OUTPUT (DOUBLE CORRUGATION)

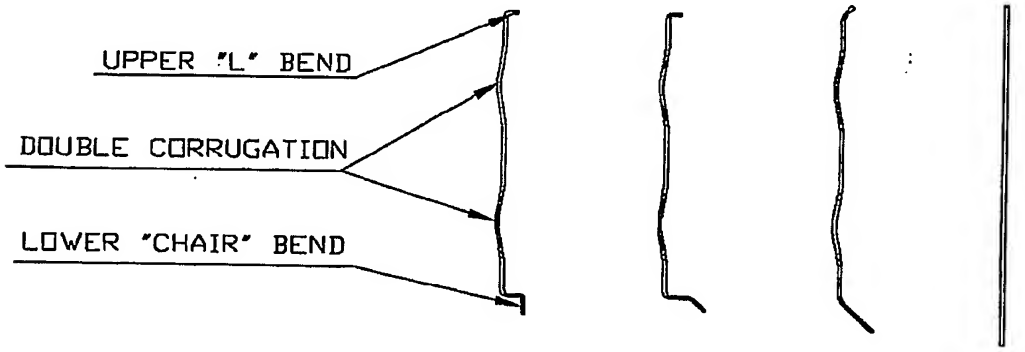

Figure IVa illustrates the welding pre-aligner as follows:

FIGURE "IV a" WELDING PRE-ALIGNER

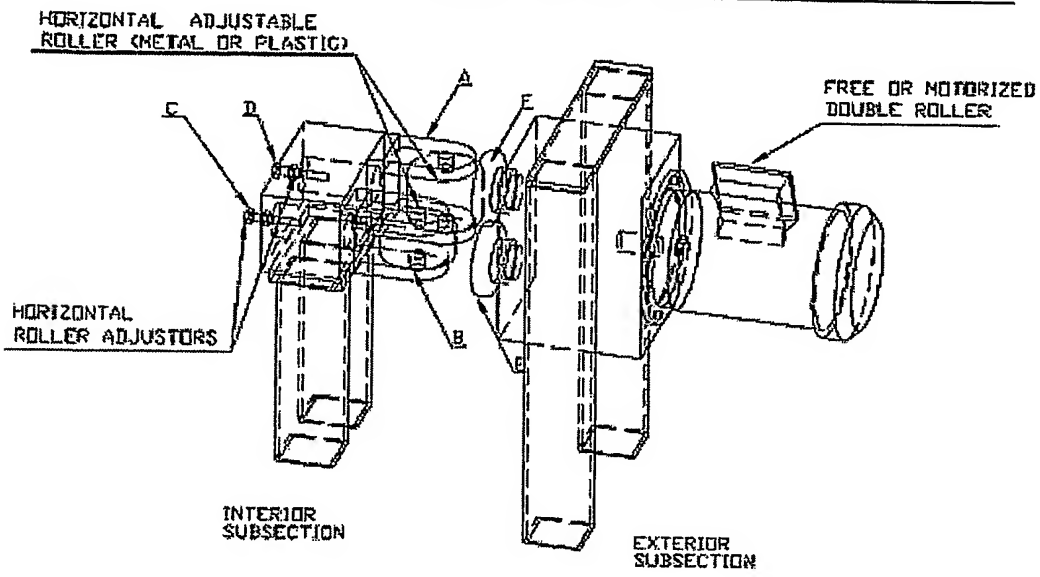

Figure IVb illustrates one example of a roller track obtained from two adjacent unwelded lower and upper coil bends.

FIGURE "IV b" UNWELDED ROLLER TRACK

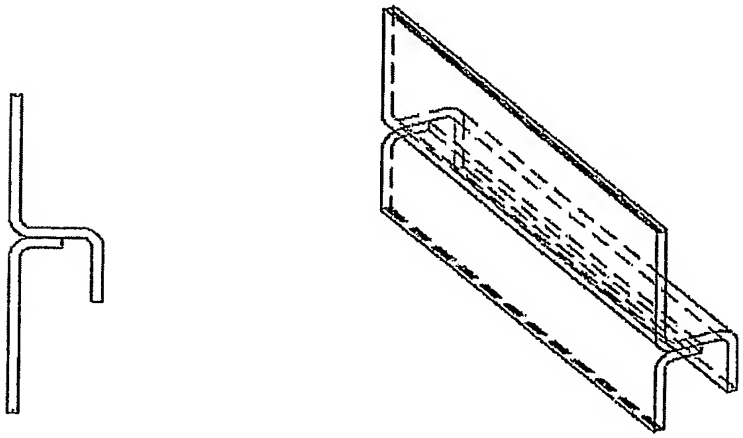

Figure IVc illustrates two adjacent unwelded lower and upper coil bends in combination with double free or motorized rollers in the welding pre-aligner (see Figure IVa).

FIGURE "IV c" UNWELDED ROLLER TRACK WITH DOUBLE ROLLERS

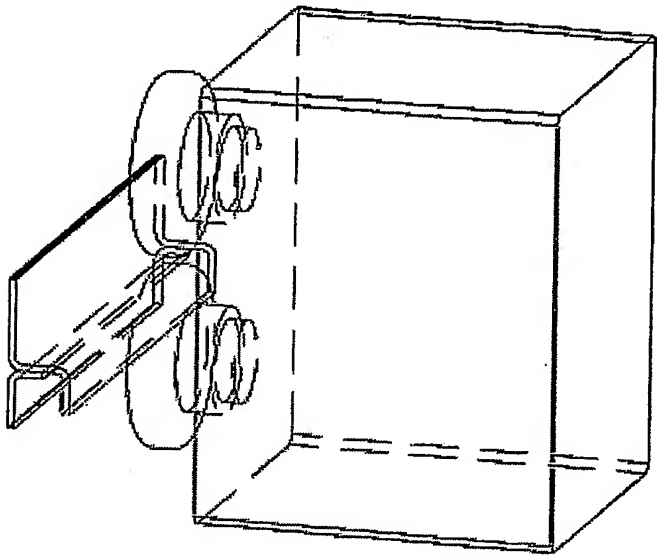

Figure Va illustrates the welding positioner as follows:

FIGURE "V a" WELDING POSITIONER

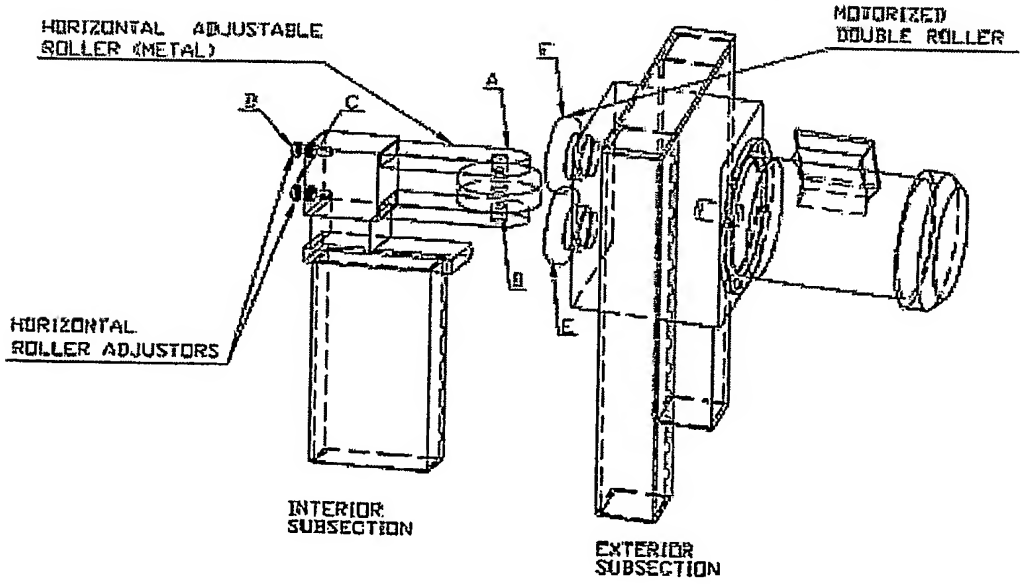

Figure Vb illustrates two adjacent unwelded lower and upper coil bends in combination with double motorized rollers in the welding positioner (see Figure Va).

FIGURE "V b" UNWELDED ROLLER TRACK WITH DOUBLE ROLLERS

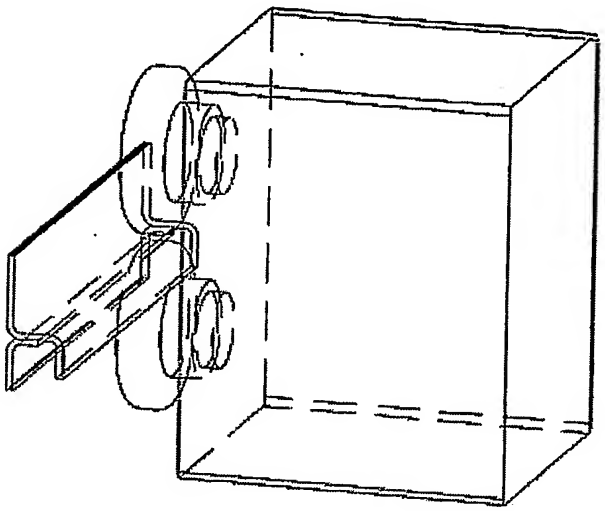

Figure VIa illustrates a single or double welder applying a continuous weld to the interior groove of adjacent chair and L bends (e.g. fillet weld) and optionally the inside of the roller track where the edge of the L bend touches the "chair bend" with the bends shown in cross-section.

FIGURE "VI a" WELDING ASSEMBLY

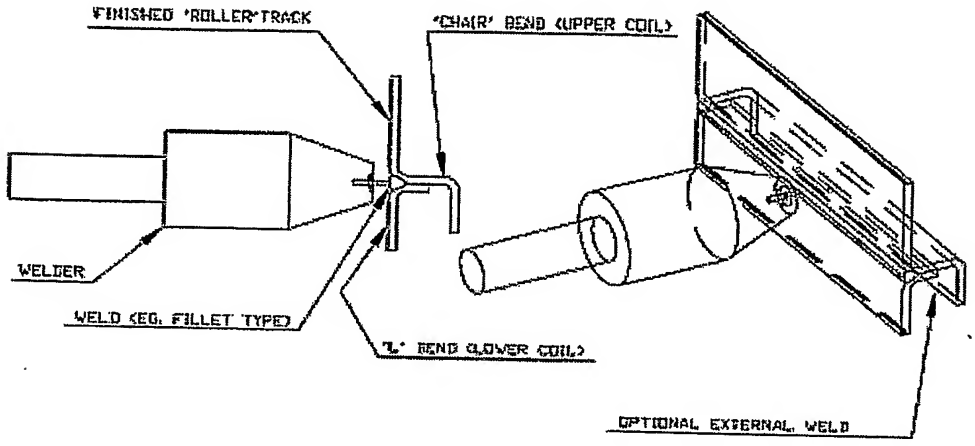

Figure VIb illustrates the interior tank side of a roller track weld.

FIGURE "VI b" INTERIOR SIDE WELDING ROLLER TRACK

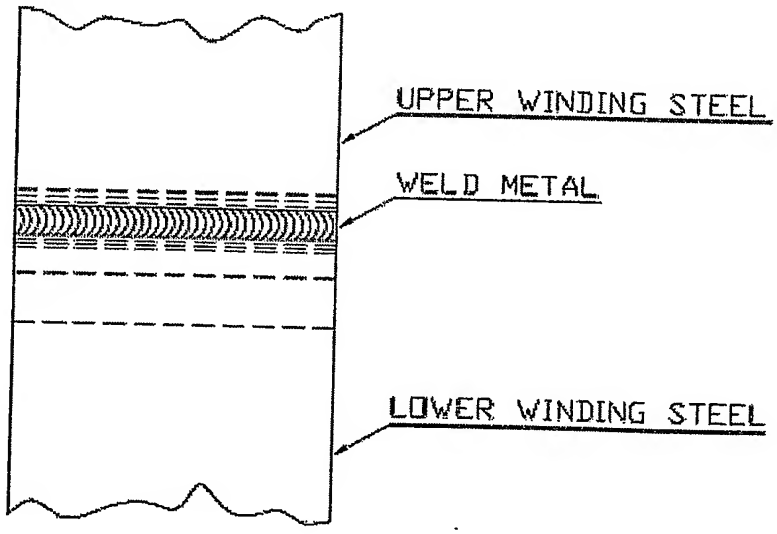

Figure VIc illustrates a single-welded roller track with part of a single free roller assembly.

FIGURE "VI c" ROLLER TRACK WITH ROLLER

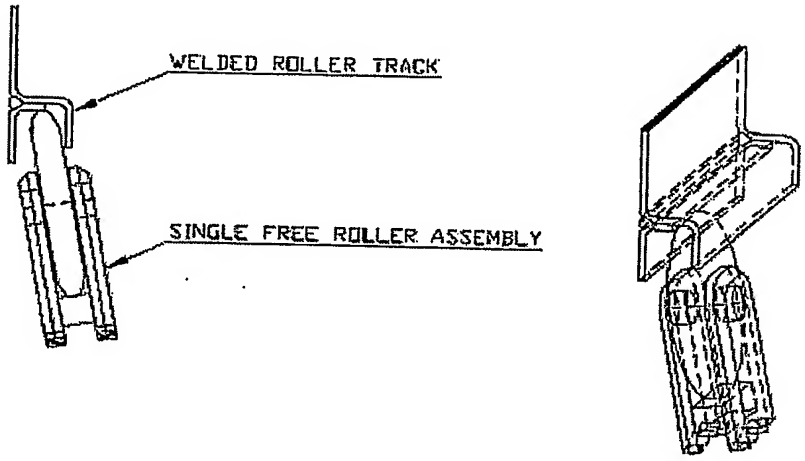

Figure VId illustrates two adjacent welded lower and upper coil bends in combination with motorized or free double rollers anywhere after the welder.

FIGURE "VI d" WELDED ROLLER TRACK WITH DOUBLE ROLLERS

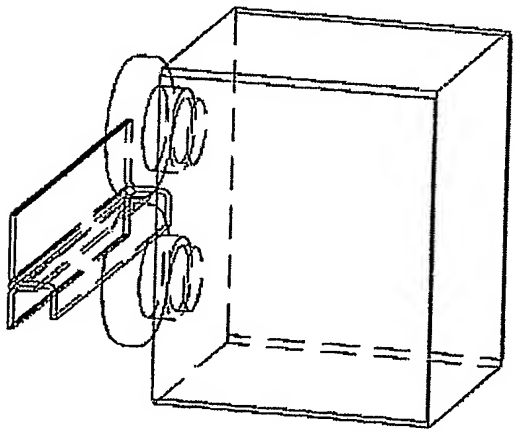

Figure VIIa illustrates a single free roller assembly as follows:

FIGURE "VII a" SINGLE FREE ROLLER ASSEMBLY

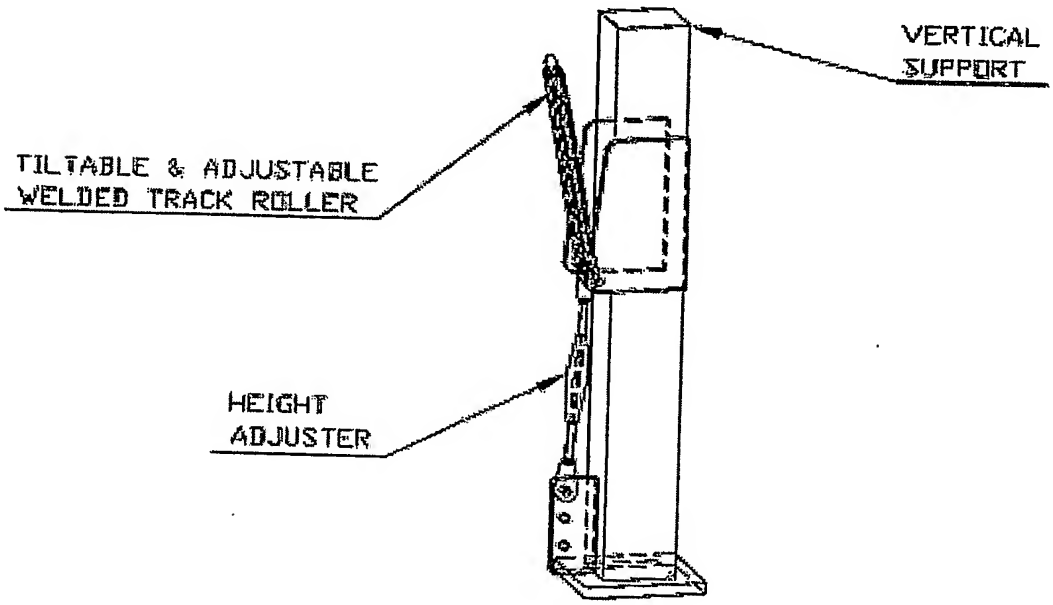

Figure VIII illustrates a decoiler assembly.

FIGURE "VIII" DECOILER ASSEMBLY

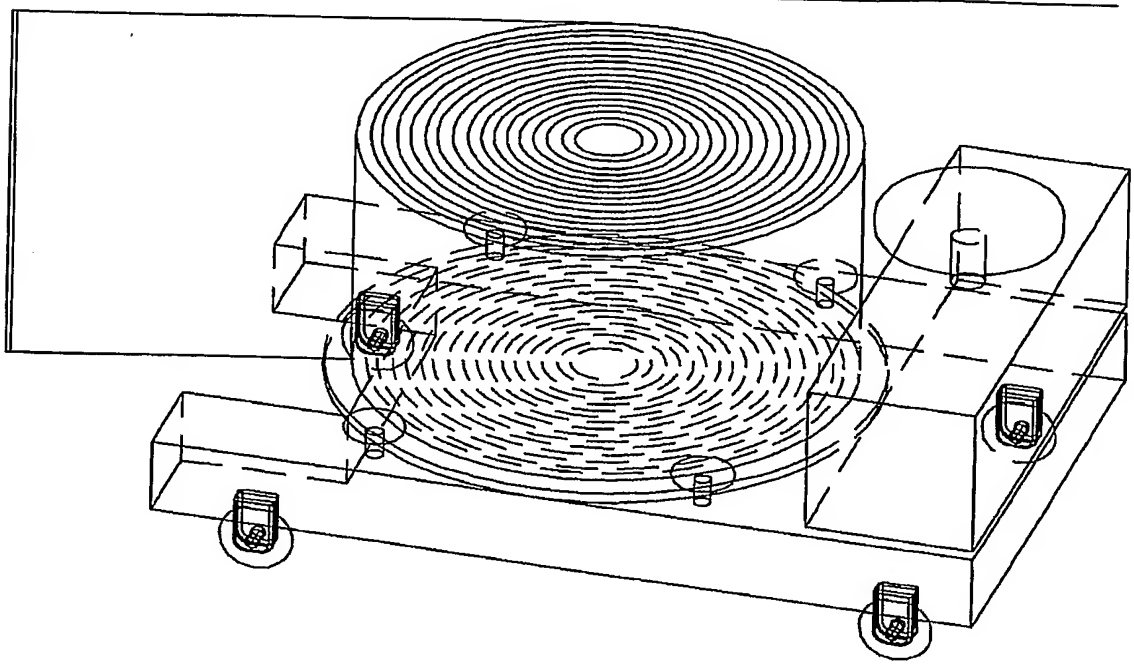

FIGURE "IX" TANK ASSEMBLY